Subject: Trillium Line Extension Project

File Number: ACS2023-TSD-RC-0009

Report to Light Rail Sub-Committee on 26 May 2023

and Council 14 June 2023

Submitted on May 16, 2023 by Renée Amilcar, General Manager, Transit Services Department

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Ward: Citywide

Objet : Projet de prolongement de la Ligne Trillium

Dossier : ACS2023-TSD-RC-0009

Rapport au Sous-comité du train léger le 26 mai 2023

et au Conseil le 14 juin 2023

Soumis le 16 mai 2023 par Renée Amilcar, directrice générale, Direction générale des services de transport en commun

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Quartier : À l'échelle de la ville

REPORT RECOMMENDATION(S)

That the Light Rail Sub-Committee recommend that Council:

1. **Approve the reporting process to Council for the Trial Running Period of the Line 2 and Line 4 extensions (Trillium Line and Airport Link), as outlined in this report; and**

2. **Direct the Transit Services Department to provide daily reports to Council advising of the outcome for the previous day's Trial Running, including the on-time performance, as outlined in this report; and**

3. **Direct the Transit Services Department to provide a technical briefing once Trial Running is complete, as outlined in this report.**

RECOMMANDATION(S) DU RAPPORT

Que le Sous-comité du train léger recommande au Conseil :

1. **d'approuver la procédure de production de rapports au Conseil pour la période de rodage des prolongements de la Ligne 2 et de la Ligne 4 (Ligne Trillium et Liaison aéroportuaire), comme décrit dans le présent rapport; et**

2. **de demander à la Direction générale des services de transport en commun de fournir quotidiennement des rapports au Conseil afin d'informer ses membres des résultats de la période de rodage de la veille, notamment la ponctualité, comme décrit dans le présent rapport; et**

3. **de demander à la Direction générale des services de transport en commun de tenir une séance d'information technique une fois la période de rodage terminée, comme indiqué dans le présent rapport.**

EXECUTIVE SUMMARY

In March 2019, City Council approved the Stage 2 Light Rail Transit Implementation Report, which included the alignment of the Trillium Line extension and the addition of the Airport Link to the scope of the Stage 2 project.

The Trillium Line Extension Project is a 12-kilometre extension of the existing single-track, diesel-powered line from its present terminus at Greenboro Station to Limebank Station in the community of Riverside South. This extension will include an additional four-kilometre spur line, including one-kilometre of double-track, to provide a connection to the Ottawa Macdonald-Cartier International Airport. In total, there will be 16- kilometres of new track, including double-tracking south of Leitrim Station to Limebank Road, eight new stations, and a significant increase to the City's park and ride capacity in the south end.

The expansion of O-Train Line 2 to Limebank and the new Line 4 to the airport will make system improvements to transit as well as reduce commute times from communities in the south end of Ottawa. The new lines will provide alternatives to avoid heavily

congested routes such as Albion Road, Limebank Road, Prince of Wales Drive, and Bank Street.

The Project will continue to be operated by OC Transpo under the regulatory name of Capital Railway as a federally regulated railway operating independently from the east-west O-Train Line 1 with a passenger transfer at Bayview Station.

As part of the February 2019 report, the Trillium Line Extension Project and related works were to be a design build finance maintain (DBFM) contract, with the proponent, known as TransitNEXT, holding the maintenance and asset lifecycle responsibilities for all the system assets to the end date of 2048.

The intention of this report is to provide a comprehensive overview for the Trillium Line Extension Project detailing the final testing program, Trial Running, path to operations, and remaining program risks.

RÉSUMÉ

En mars 2019, le Conseil municipal a approuvé le Rapport sur la mise en œuvre de l'Étape 2 du train léger sur rail, qui comprenait le tracé du prolongement de la Ligne Trillium et l'ajout de la liaison aéroportuaire à la portée de l'Étape 2 du projet.

Le projet de prolongement de la Ligne Trillium consiste en un prolongement de 12 km de la voie simple de la Ligne Trillium, présentement desservie par un train fonctionnant au diesel, à partir de l'actuel terminus de la station Greenboro jusqu'à la station Limebank dans la communauté de Riverside-Sud. Ce prolongement comprendra une ligne secondaire supplémentaire de quatre kilomètres, dont un kilomètre sur voie double, pour fournir un lien vers l'Aéroport international Macdonald-Cartier d'Ottawa. En tout, il y aura 16 kilomètres de nouvelle voie, y compris une voie double du sud de la station Leitrim au chemin Limebank, huit nouvelles stations, et une augmentation significative de la capacité du parc-o-bus de la Ville à l'extrémité sud.

Le prolongement de la Ligne 2 de l'O-Train jusqu'au chemin Limebank et la nouvelle Ligne 4 vers l'aéroport permettront d'améliorer le réseau de transport en commun et de réduire le temps de déplacement pour les communautés à l'extrémité sud d'Ottawa. Les nouvelles lignes offriront des solutions de rechange pour éviter les rues très congestionnées comme le chemin Albion, le chemin Limebank, la promenade Prince of Wales et la rue Bank.

Le projet continuera d'être exploité par OC Transpo sous le nom réglementaire de Chemin de fer de la Capitale en tant qu'entreprise ferroviaire réglementée par le

gouvernement fédéral et indépendante de la Ligne 1 est-ouest de l'O-Train. Le projet comprend une correspondance de passagers à la station Bayview.

Dans le cadre du rapport de février 2019, le projet de prolongement de la Ligne Trillium et les travaux connexes devaient faire l'objet d'un contrat de conception, construction, financement et entretien (CCFE), et il revenait au promoteur, connu sous le nom de TransitNEXT, d'assumer les responsabilités de l'entretien de tous les actifs du réseau jusqu'à la fin de 2048.

Le présent rapport vise à fournir une vue d'ensemble du projet de prolongement de la Ligne Trillium qui décrit le programme d'essai final, le déroulement du rodage, la marche à suivre pour les opérations et les risques restants liés au programme.

BACKGROUND

The original north-south O-Train line began operations in October 2001 as an eight-kilometre diesel light-rail service. This system was designed as a pilot project that would provide an alternative to the north-south bus rapid transit serving Bayview, Carling (now Dow's Lake), Carleton, Confederation (now Mooney's Bay) and Greenboro stations. This system also included the re-use of an existing 750-metre railway tunnel under Dow's Lake with a maintenance and storage facility located at the Walkley Yard. From 2001 to 2015, the north-south O-Train operated three Bombardier Talent diesel multiple-unit (DMU) vehicles and provided service every 15 minutes with two trains in service.

Effective March 2015, the City launched an expanded north-south O-Train service running 12-minute headways with four trains in service. The Project included the construction of new sidings, track and signal upgrades, as well as the purchase of six Alstom LINT DMU vehicles to replace the Bombardier cars from 2001.

In May 2020, the City closed the existing north-south O-Train Line 2 service to permit the construction of the Stage 2 south extension, the Trillium Line project.

O-Train Lines 2 and 4 will continue to be operated by the City of Ottawa with maintenance services contracted to TransitNEXT. The City of Ottawa will take over the dispatch and rail control functions as part of the expansion of the line. Based on construction progress to date, the new, expanded lines are expected to open later this year.

DISCUSSION

1. Project Design Overview

The Trillium Line Extension Project adds approximately 12 kilometres to the existing single-track, diesel-powered line from its present terminus at Greenboro Station to Limebank Station in the community of Riverside South. The project also includes an additional four-kilometre line, including one kilometre of double-track, to provide a connection to the Ottawa Macdonald-Cartier International Airport. In total, there are 16 kilometres of new track, including double tracking south of Leitrim Station to Limebank Station, eight new stations, and a significant increase to the City's park and ride capacity in the south end.

The Trillium Line Extension Project contains many elements of work within its overall scope, as well as several associated elements of work that will enable the entirety of the Project to function in an effective manner for the City. The Project will continue to be operated by OC Transpo under the regulatory name of Capital Railway as a federally regulated railway that will operate independently from O-Train Line 1, with a physical separation and passenger transfer at Bayview Station.

The Extension Project includes several operational enhancements planned to strengthen service and to provide more system flexibility to overcome minor delays and quicker recovery times. Key enhancements consist of:

- Lengthening existing passing sidings;
- Providing extensive portions of new double-track in the southern extension;
- Providing two-track terminal stations at both Bayview and Limebank; and
- Grade separating the Ellwood Diamond allowing VIA trains to pass below Line 2 with no impact to service.

All three existing passing sidings at Gladstone, Carleton and Brookfield have been lengthened to improve operations. The completed six-kilometre section of track from Leitrim Station to Limebank Station is also double-tracked. The terminal stations at Bayview and Limebank are being double-tracked so that an out-of-service train can be parked at the station while the line remains in operation – this eliminates the scenario where a single out of service train at the end of the line affects operations.

Enhancements to all existing Line 2 stations have included the reconstruction and lengthening of platforms to 77 metres in order to accommodate the longer Stadler trains and two-car trains of the Alstom vehicles. Additionally, the signage, lighting and communications systems will also be upgraded at these stations. Notably, a second

elevator is being added at Dow's Lake Station to provide additional capacity and redundancy.

Several bridges for cyclists and pedestrians are being constructed as part of the Project:

- Pedestrian bridge at Bayview to link with the development at 900 Albert Street;
- Multi-use bridge (cycling and walking) over the Rideau River at Carleton University;
- Multi-use bridge (cycling and walking) over Hunt Club Road to connect the north south MUP network; and
- New bridge that will also function as a wildlife crossing at High Road.

a. Airport Link

The Airport Link is a four-kilometre line connecting from the main Line 2 at South Keys Station to the Ottawa Macdonald-Cartier International Airport. This service will operate as O-Train Line 4. This link will include two new stations: Uplands Station and Airport Station which both have 40-metre platforms, long enough for the Alstom cars that will run on this line. Infrastructure is in place to support an extension of these stations' platforms to accommodate larger vehicles in the future.

South Keys Station is being expanded to include a new train station and platforms in addition to the current bus platforms on the Southeast Transitway. South Keys Station will serve as the transfer station from buses and north-south trains on Line 2 to and from the trains on Line 4. Line 4, the airport link, will operate on a 12-minute headway interleaved with mainline Line 2 trains that are also operating at 12-minute headways.

The Airport Authority has designed and constructed and will maintain a concourse at Airport Station that connects directly to the airport terminal (Figure 1). The concourse will provide a waiting area for transit customers that is directly connected to the airport terminal. The Airport Station concourse will contain seating, route maps, fare control equipment and other amenities. TransitNEXT has coordinated its design and the construction of Airport Station with the Airport Authority to ensure the integration of the platform and concourse is seamless.

Figure 1: Airport Station

b. Stations

The design of the Trillium Line stations mirror, where appropriate, the standardized elements conceived for the Stage 1 Confederation Line Project to provide a more cohesive design across the transit system. The standardized elements include:

- Fare gates, comprised of a minimum of four fare gates, including accessible fare gates at each entrance and associated fare barriers;
- A set of two elevators will be provided at new stations where required;
- Accessibility features such as Tactile Walking Surface Indicators (TWSI's) and tactile signage;
- Framed glazed windscreen and guard rail system;
- Wayfinding and signage on the platform and canopy;
- Platform edge warning strip;
- Transecure area with utility cabinet;
- Fare Vending Machines and signage;
- Rail and bus operator crew facilities;
- Benches; and
- Bicycle racks and shelters at the entrance plaza of each station, where appropriate.

All stations are enhanced with specific accessibility and safety amenities as part of the Project. Stations are designed to best practice CPTED (Crime Prevention Through

Environmental Design) principles. Life safety features to support emergency services response and passenger evacuation are included throughout the stations.

The stations are also designed and constructed to meet universal accessibility requirements, including the *Accessibility for Ontarians with Disabilities Act* (AODA), the Ontario Building Code, and the updated City of Ottawa Accessibility Design Standards.

Corso Italia Station (originally referred to as Gladstone Station) is a newly constructed station along the existing Trillium Line, in the excavated limestone rail trench north of and below Gladstone Avenue. Two 77-metre-long platforms have been constructed in the guideway trench on each side of the double tracks with an entrance pedestrian plaza located at street-level. The platforms will provide weather protection in the form of canopies, in addition to fare-gates, elevators, and bicycle parking connecting to the existing north-south multi-use pathways (MUP).

Figure 2: Corso Italia Station

On the other hand, Dow's Lake Station (formally Carling Station) is an existing station located below grade in the trench, north of Carling Avenue. This station consists of a single 35-metre-long platform on the east side of the tracks. As part of this Project, the platform has been extended for a total length of 77 metres, as required to accommodate longer trains.

Figure 3: Dow's Lake Station

c. Trackwork

The mainline track is primarily ballasted track but does including some short sections of direct fixation track. The original segment (between Bayview and Greenboro stations) is predominantly ballasted track on timber ties. The new ballasted track segment (south of Greenboro Station) consists of concrete ties. The sections of direct fixation track are located on the elevated guideway adjacent to Airport Station and the elevated guideway crossing the VIA Rail tracks.

The special trackwork consists of a mixture of existing and new turnouts: sizes range between #7 and #20, noting that the higher number refers to a larger turnout which in turns allows for faster train speeds across the trackwork. All existing and new special trackwork are equipped with manganese frogs and switch slide plate rollers, thus increasing the special trackwork life and eliminating the need for lubrication.

The expanded track still allows for freight access to the National Research Council (NRC) from CN's Walkley Yard using the access switch on Line 2 just south of Lester Road. As well, the Walkley Diamond crossing allows CN freight trains to cross the Line 2 mainline for track access on the CN Walkley Line.

The revamped Dow's Lake Tunnel track includes a new track structure including new concrete ties, new tunnel ventilation systems, new radio coverage for the City's P25 system, and new cellular coverage end-to-end for customers.

d. Track Alignment

For much of the existing alignment between Bayview and Greenboro stations, the O-Train line is limited to the existing width of the railway trench corridor. Double-track passing sidings between Bayview and Corso Italia stations, at Carleton Station, Brookfield, Uplands and the full alignment south of Leitrim Road, offer the opportunity for two trains moving in opposite directions to pass safely, thereby reducing the risk of conflicts between trains travelling in opposing directions on a single track, while also permitting the system to maintain 12-minute headways.

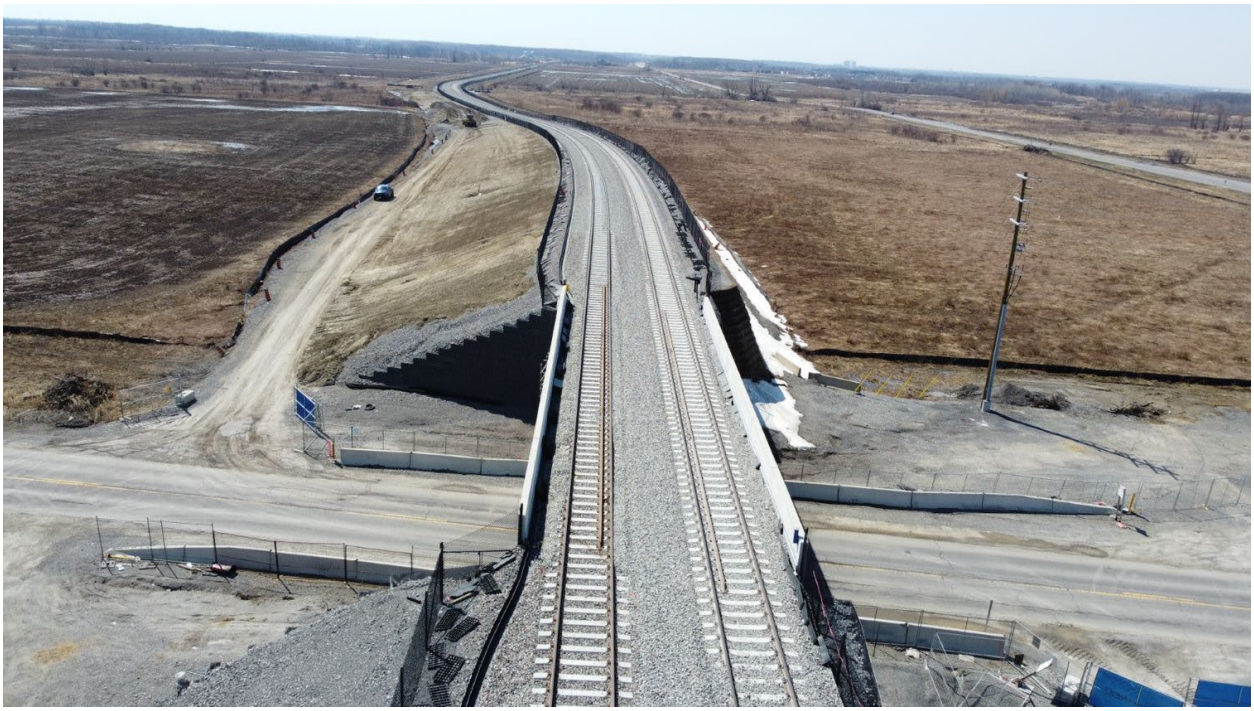

Figure 4: Ballasted Track at Bowesville Road

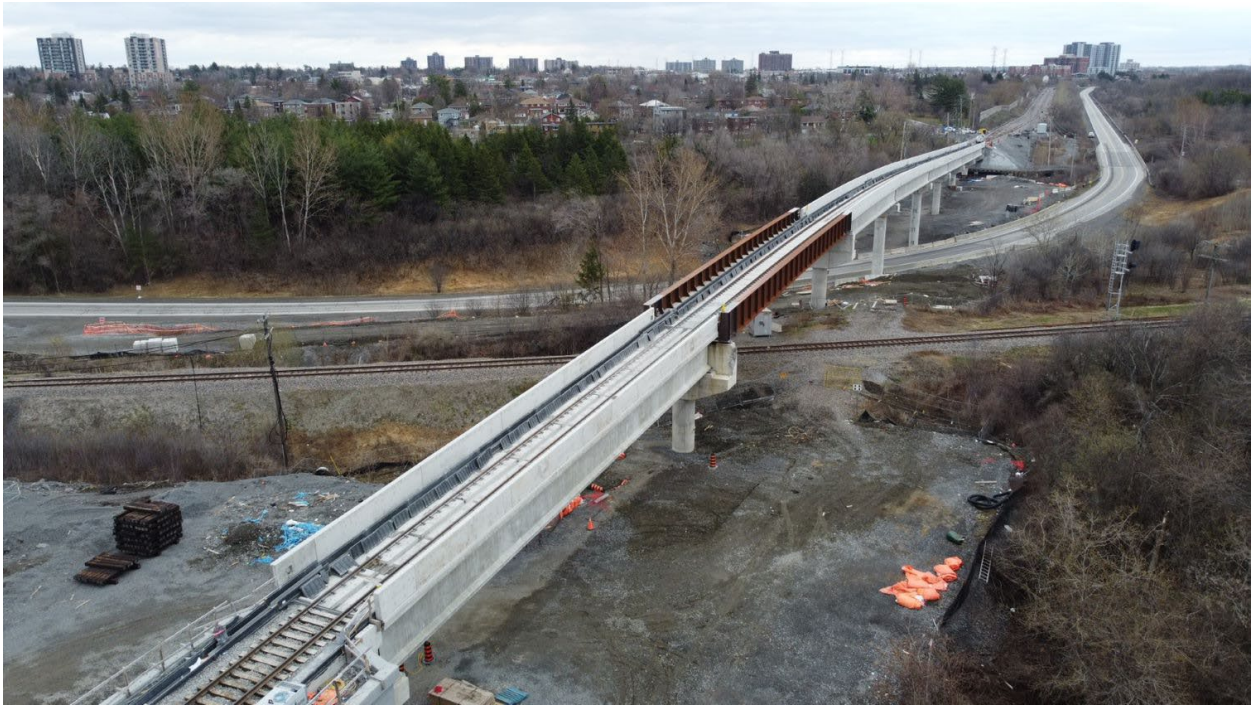

Figure 5: Direct Fixation – Ellwood Grade Separation

e. Structures, Diamonds and Crossings

The Project includes a combination of new structures, diamonds and crossings, and repairs, modifications or replacement to those currently existing. Most structures are rail-related though there are some pedestrian or wildlife-only structures.

The City will submit a Bridge Safety Management Program (BSMP) to Transport Canada as part of the regulatory framework. The structures, diamonds, and crossings outlined below will add to the track work described above to create a fully grade separated rail alignment from the public right-of-way.

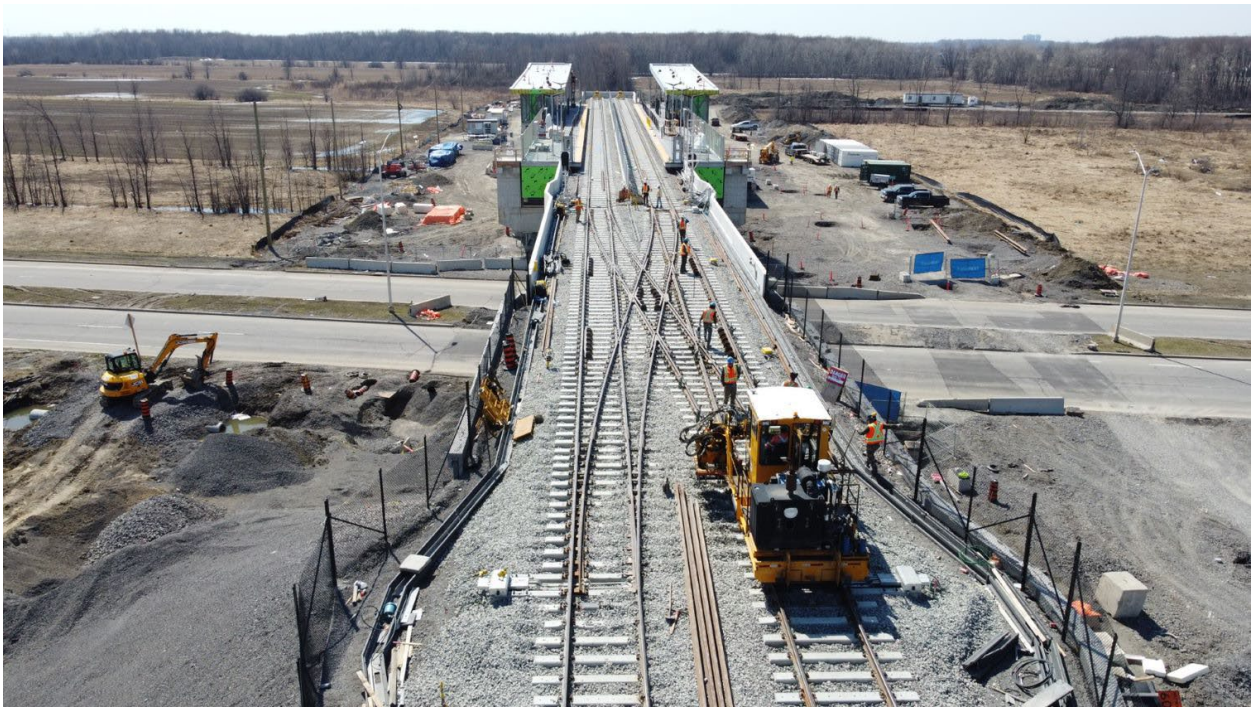

Figure 6: Elevated Diamond Crossover at Limebank Station

f. Albion Yard Maintenance and Storage Facility

During the Project planning phase, it was determined that the construction of a new Maintenance and Storage Facility (MSF) on City-owned land, west of Albion Road, would be preferred over renovating and expanding the existing Walkley Yard MSF. A portion of the existing Walkley Yard will continue to be used for vehicle storage tracks. A dedicated building with a heavy maintenance bay, an inspection pit, wheel lathe, and other facilities for vehicle maintenance has been constructed. Additionally, a second inspection building including two lanes of inspection pits, refueling facilities, sanding functions, and a car wash function has also been constructed. The site will be fully secured with perimeter fencing and access will be controlled.

The new Albion Yard (Figure 7) provides for the efficient movement of system vehicles from the mainline track to storage tracks. The new Albion Yard MSF building includes facilities for the City's operations team.

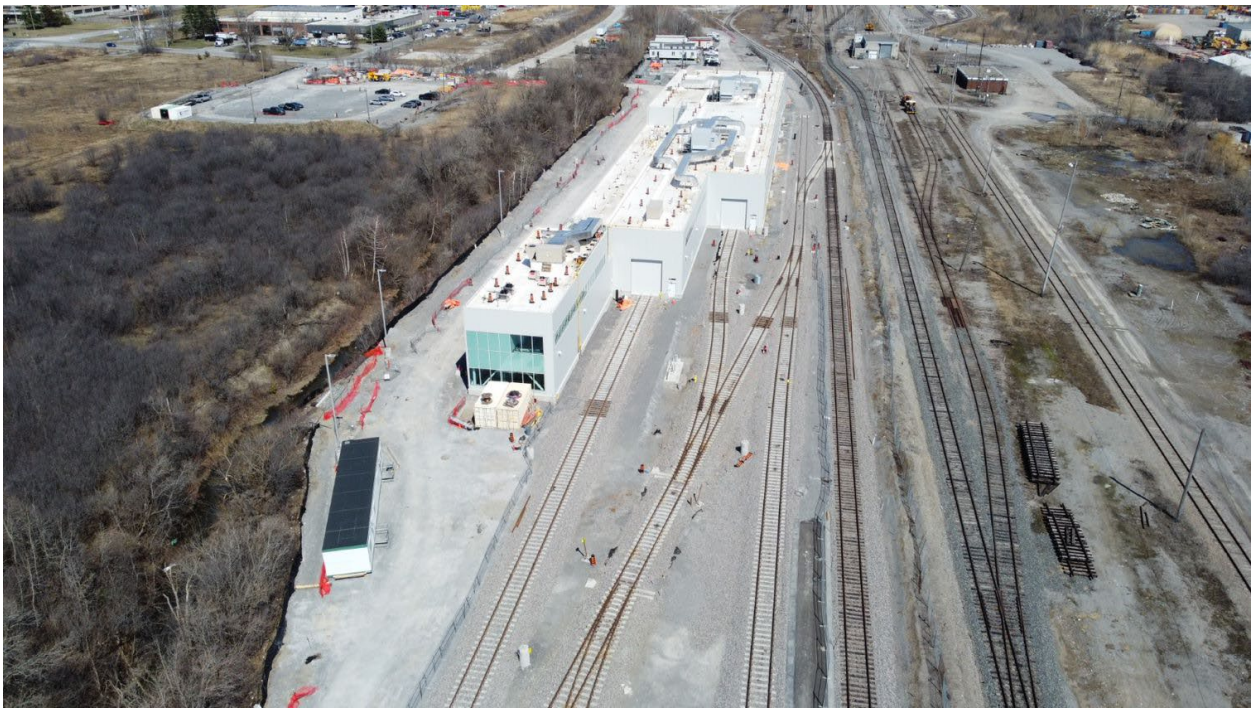

Figure 7: Albion Yard Maintenance and Storage Facility

g. Vehicles and Vehicle System Technologies

The Project has added new diesel multiple unit (DMU) vehicles and technology to meet the current and future capacity needs of the service. Seven vehicles in total will be required for Line 2 to provide service between Bayview and Limebank stations. Two vehicles will provide service to the airport on Line 4. All of the vehicles include an upgraded CCTV system, a new radio system, as well as a new on-board signaling system.

Two different vehicle types will operate on the expanded lines. Six 40-metre Alstom LINT vehicles (Figure 8) were already in use on O-Train Line 2. As part of Stage 2 Trillium Line Project, the City has procured seven 80-metre Stadler FLIRT diesel multiple vehicles (DMU) (Figure 9) which were built in pre-existing, dedicated manufacturing facilities. The Line 2 mainline will run a mixed fleet of the two vehicle types, while only the Alstom LINT vehicles will operate on Line 4 to the airport.

The new Stadler vehicles will go into service when the extension opens. The longer, and therefore higher capacity Stadler FLIRT vehicles, enable the City to increase the passenger capacity of each train in order to meet ridership demands. There is the potential for electric conversion of these vehicles in the future.

As part of early planning, staff investigated the option to electrify the line and determined this type of investment could not be supported given the ridership projections for the line. At peak, ridership levels will be less than 15 per cent of ridership levels on O-Train Line 1. Options to convert the Stadler trains to electric with the construction of an overhead catenary system exist. There are also other emerging technologies such as battery-based vehicles that may become available in the future.

Additional details can be found in Document 1 providing background information on the project design and construction, including an outline of the quality assurance mechanisms in place.

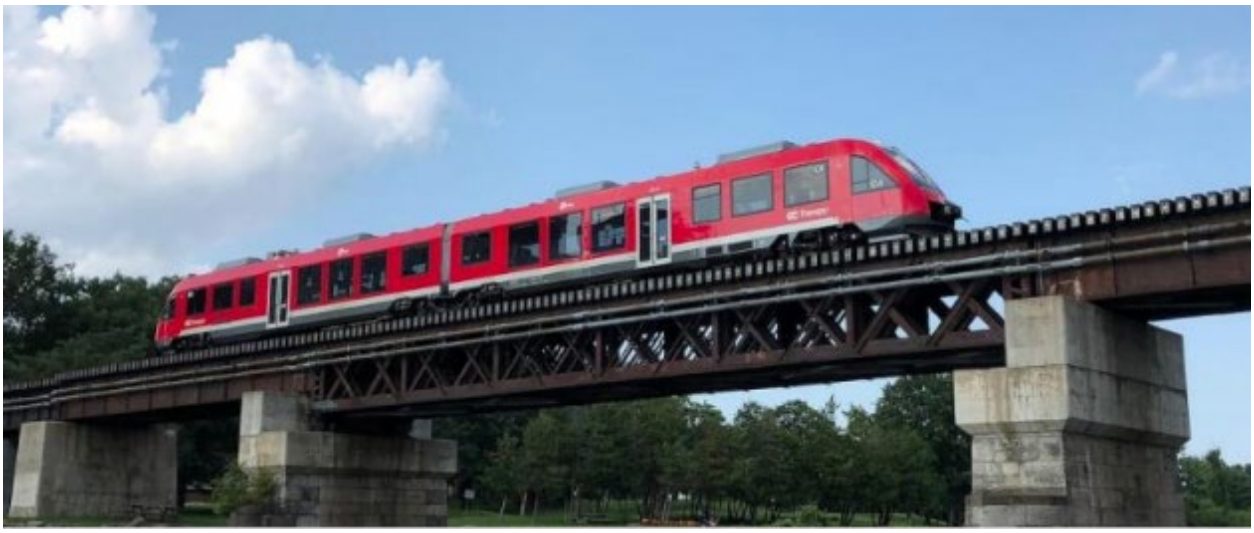

Figure 8: Alstom LINT Diesel Multiple Unit (DMU)

Figure 9: Stadler FLIRT Diesel Multiple Unit (DMU)

h. Communications Systems

The original north-south O-Train service was controlled out of a contractor's remote facility in Dorval, Québec. The decision was made to bring this function in-house which required the construction of new control desks in the City's Transit Operations Control Centre (TOCC). The ability to directly control and dispatch trains, combined with the safety and security functionality available in the TOCC, will help improve the City's overall control of this network.

In order to support this change in operational approach, new communications systems are being integrated into the head-end systems at the TOCC and Backup Control Centre (BCC). TransitNEXT is responsible for providing all field devices, local hardware as well as leading the integration with the City provided head-end management systems. The approach to bring the rail dispatch function in house, has led to new recruitment and training needs to staff the control centre for these new functions.

i. Connectivity

The Trillium Line Extension Project has implemented several connectivity enhancements. These enhancements together with the east and west Confederation Line extension projects will add roughly $20 million of infrastructure to advance the City of Ottawa's pedestrian and cyclist network. Critical connections at stations will be provided, as well as fully accessible pathways to each Stage 2 O-Train station. Enhancements to the pathway network by providing a parallel pathway along the length of the extension, integrating into the new stations and connecting to adjacent communities and destinations. Starting at South Keys Station and across the new pedestrian bridge over Hunt Club Road, a pathway connection is provided along the east side of the alignment through to Bowesville Station.

j. Public Art

Jason Bruges Studio (https://www.jasonbruges.com/) (JBS), a UK-based artist team selected for the Trillium Line Extension Project public art project through an open international call to artist teams designed, fabricated and is installing digital media public art within three stations along Line 2 - Corso Italia, South Keys, and Limebank.

JBS have created a reputation for making invisible everyday forces and interactions visible. The artworks are informed by a combination of data inputs (cameras) throughout the stations that are driven through custom software to control bespoke lighting engines. For this project, JBS has focused on themes of turbulence and flow - visualizing what happens to space and place when people and trains pass through them. The sculptural arrangements take cues from the trillium flower as well as the standardization and

modularization seen within global train station design to produce artworks which represent eddies and turbulence, while also providing a versatile canvas for varying content. This concept has informed the artwork arrangement, position, function, and physical structure making the overall custom shape developed at each station. The artwork will become interactive based on the real-time data received by the cameras placed throughout the stations capturing passenger flow and train movement.

JBS, the City and TransitNEXT have been working diligently over the course of the past few years to integrate and implement this project cohesively within the stations' communications, electrical and structural infrastructure to ensure the project is launched in tandem with the start of Line 2 service.

k. Indigenous Engagement

City staff continue to consult and engage with representatives from local Indigenous communities on the Stage 2 Light Rail Transit project. These representatives include: Algonquins of Ontario (AOO), Algonquins of Pikwàkanagàn, Kitigan Zibi Anishinabeg First Nation, and Métis of Ontario.

Indigenous engagement with artists for the Algonquin Directional Signage, an initiative developed to celebrate and strengthen Algonquin art and culture throughout Ottawa is ongoing. The City is consulting with the artists on the placement of the Algonquin Directional Signage (Figure 10) at the Lines 2 and 4 stations.

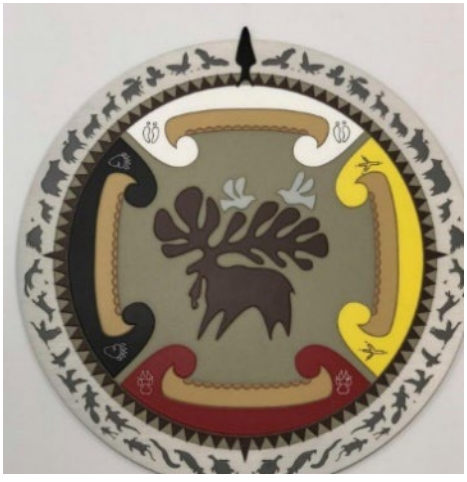

Figure 10: Algonquin Wayfinding Wheel

I. Communications and Stakeholder Engagement

Since the initiation of the Stage 2 O-Train South project, the communications and stakeholder engagement team has connected with Councillors and residents keeping them updated on construction progress. To date, the team has hosted or attended regular public engagement activities including community meetings and Stage 2 Information Sessions and councillor briefings, averaging at five per year. Public resources are found on the project website, Ottawa.ca/Stage2 (attracting more than 200,000 views per year on average), the project newsletter (with over 2,000 subscribers), and the Stage 2 Instagram (attracting close to 1,000 followers). Since the project has started the team has also released quarterly construction lookaheads to inform residents of work in their area.

A marketing and customer information campaign is being developed to educate and build excitement around this year's launch of O-Train Lines 2 and 4. The campaign will leverage a newly designed website and communicate to residents through both organic social media and paid media strategies. An opening event is planned for the lead up to the launch, among other customer outreach activities. The campaign forms part of a larger strategy to improve customer communications and build public trust.

2. Project Delivery

As part of the overall Stage 2 project delivery, a number of new processes have been embedded into the Project Agreements such as the inclusion of a System Integration Verifier (SIV). Additionally, there are rail related project functions such as safety assurance, certification, training and regulatory approvals that are important to highlight as part of a summary of overall project activities.

a. System Integration Verifier (SIV)

The Stage 2 Project Agreement adopted lessons learned from Stage 1 and required TransitNEXT to undertake a robust approach to systems integration activities which is based on a systems engineering approach defined by European Standards EN 50126, 50128, and 50129 and ISO/IEC/IEEE 15288:2015 standard. These standards establish a defined framework which directs what systems integration activities need to take place during each project phase using a regimented project management approach.

To assist with the integration work between the TOCC upgrades being completed by the City and the field equipment being installed by TransitNEXT, the City has engaged an independent third-party System Integration Verifier (SIV), who will scrutinize the systems integration activities during the installation, testing and commissioning phases to ensure it is following good industry practice and to help resolve any disputes using a fast-track

dispute resolution process. The Trillium Line SIV contract was awarded to Ricardo Rail, an international multi-disciplinary engineering consultancy firm.

In November 2022, the Stage 1 Public Inquiry published a series of recommendations for future projects, including one specific to Trial Running stating that “an independent expert should be appointed who must (i) assess trial running criteria and performance, and (ii) approve any material change to the trial running criteria or process.”

In order to meet the requirements of the Public Inquiry recommendations, and in light of the PA requirements for Trial Running, the City will further engage the SIV to include independent Trial Running oversight. Specifically, the SIV’s oversight of Trial Running includes the following:

1) **Pre-Trial Running:**
    - Participate in the Trial Running Working Group Team in an independent capacity in order to provide input or feedback during confirmation of the Trial Running criteria; and
    - Develop a Trial Running Oversight Plan.

2) **During Trial Running:**
    - Participate in the daily Trial Running meetings where performance of the previous day(s) is reviewed;
    - Assess Trial Running performance criteria by reviewing the reported performance against the criteria (may include on-site verifications);
    - Ensure the established performance criteria are used for the performance evaluation;
    - Provide approval of any material change to the performance criteria or to the process;
    - Write a daily summary report on the process followed, the assessment of the performance evaluation result (were all criteria met), and any other noteworthy elements; and,
    - Circulate the daily summary to all Project parties (City, TransitNEXT, Independent Certifier) prior to the next meeting the following day.

3) **Post-Trial Running:**
    - Provide a verbal recommendation for acceptance immediately following Trial Running;
    - Two days after completion of Trial Running, submit final summary report (collating all previous daily reports) with recommendation for acceptance; and,

- Circulate the final summary report to all Project parties (City, TransitNEXT, Independent Certifier).

More information on lessons learned from the opening of O-Train Line 1 specifically from testing and commissioning and Trial Running can be found in Document 2 of this report.

b. System Engineering and Safety Assurance

The Stage 2 Trillium Line Project Agreement required that TransitNEXT undertake a rigorous system safety assurance process to certify that all elements of the new expanded system are safe prior to the start of revenue operations. TransitNEXT's system safety and assurance process is guided by the Systems Engineering approach and standards (including CENELEC standards) that defines and manages safety assurance activities during each project phase including hazard analysis; risk assessments; certification plans; assurance plans, which feed into development of successive safety documentation to support the overall process outlined in the plan. This iterative approach to system safety and assurance ensures that TransitNEXT is regularly identifying, reviewing, and mitigating the various hazard and safety requirements throughout all phases of the project.

The City is overseeing all aspects of the safety certification process through a joint team of City staff, the City's Owner's Engineer, and an Independent Safety Auditor (ISA). The City has engaged SENER Inc. as the project ISA, an international engineering and technology firm with wide experience in safety auditing and acceptance services. SENER is a certified Railway Independent Safety Auditor that has provided ISA services throughout the world, including Metro Line 9 to the Barcelona International Airport (Spain), the Zapopan to Guadalajara and Tlaquepaque light rail system (Mexico), and the Lusail light rail tramway (Qatar).

The ISA will verify that TransitNEXT approach to system safety and assurance is sound, that it has fulfilled compliance with all safety requirements throughout each project phase, and ultimately, will provide the City with the required assurance for system certification acceptance required ahead of the start of revenue service.

c. Security Management

In addition to a safety assurance process, requirements for security management are embedded in the Project Agreement. TransitNEXT and the City conduct regular meetings to track this process on the implementation of security measures through the design and as part of operational procedures. An updated Threat Vulnerability Assessment and Threat Log provide detailed responses and mitigations to threats. These updates are

expected to address all security concerns/issues through a detailed review process by City stakeholders.

An independent Security Audit by Atkins Physical Security and Resilience was conducted to validate the System Security Certification and System Security Assurance Plans as well as the Physical Security Strategy and Threat Log with observation that were all satisfactorily resolved. The security audit concluded that all processes, documentation, and activities are in accordance with BS ISO 31000 on Risk Management standard.

d. Operations Training

Importantly, training for staff who will operate the system is a critical step in delivering the project. The Stage 2 Trillium Line training and curriculum program is a highly integrated program coordinated between OC Transpo, the Rail Construction Program (RCP) and TransitNEXT. This program consists of a detailed training curriculum, based on an approved system to ensure that OC Transpo Instructors, Diesel Rail Operators, Diesel Rail Controllers and TNEXT maintenance staff are ready for operations.

TransitNEXT is required to use a train-the-trainer approach in order to support City operations training. In turn, the City's trainers will provide training to operators ahead of revenue service. This training will be provided both in-class and on the job.

The Rail Construction Program office along with TransitNEXT are working closely to ensure that track and vehicles are available to permit on the job training to start as of May through to Trial Running. Following Substantial Completion, OC Transpo will assume responsibility for operations, safety and maintenance training through internal resources or subcontracts.

e. Emergency Responder Training

In addition to training for operations staff, there are specific obligations in the Project Agreement for TransitNEXT to provide familiarization training to emergency responders. Typical training for emergency responders may include overview of vehicle features, site familiarization, and other technical topics such as rerailing. In order to deliver this training, a series of tabletop exercises, classroom and practical training, and familiarization sessions have been organized. Tabletop exercises are conducted in an open forum discussion with various groups including emergency responders, transit staff and external stakeholders discussing simulated emergency scenarios.

To date, four tabletop exercises have taken place including scenarios specific to:

- A person of interest in an assault and fleeing the scene leaving an injured bystander.
- A suspicious package involving a bomb threat scenario with a train/station evacuation.
- An event involving a person with a weapon who is barricaded in a station.
- A pedestrian struck by a train.

The fifth tabletop exercise will be dedicated to preparation for a full-scale live exercise, planned for September 2023, where all responders will be at the scene dealing with events in real time. This scenario will involve an incident on the train and will require evacuation of injured passengers. The final tabletop will be preceded by classroom and practical training including familiarization for both train sets, new stations, and emergency response systems on the Trillium Line.

Following each exercise, an After-Action Review is conducted and the actions from these reviews are completed prior to Substantial Completion.

f. Independent Project Oversight

A key step in completing the project is the engagement of an Independent Certifier (IC) who works on behalf of the City and TransitNEXT to actively review the progress of works on site and who authorizes payments for works completed. The IC assigned to the Stage 2 Trillium Line Project, AW Hooker, is actively reviewing project progress and certifying payments as part of their services to the Project. The IC will also certify achievement of Substantial Completion prior to handover to the City.

In addition to the Project Agreement requirements for an IC, there are a variety of independent regulatory bodies including Transport Canada, Building Code Services, Technical Standards and Safety Authority (TSSA), and Ottawa Fire Services who all play an important role in ensuring that station and systems elements meet pertinent code requirements and are safe for use by the public.

g. Rail Regulatory Approvals

Notably, O-Train Lines 2 and 4 make up a federally regulated railway, under the name Capital Railway, and the City is actively engaged with Transport Canada and the Canadian Transportation Agency to obtain the necessary regulatory approvals, including an amended Railway Operating Certificate and an updated Certificate of Fitness respectively, required to permit the resumption of service on the expanded lines. Further information regarding appointments to the Stage 2 Trillium Line Project to support the delivery and startup of the project are described in Document 3.

Additional approvals are required on new and updated documentation for updated operating rules, updated track safety rules, updated vehicle inspection rules as well as a vehicle compliance documentation, and a variety of other secondary supporting documents to show compliance with the various standards and regulations maintained by Transport Canada. Importantly, an updated Safety Management System (SMS) is required prior to the start of operations.

3. Overall Testing Program and Durations

The overall testing program initially started with activities that could be categorized as vehicle testing and non-vehicle system testing. Later in the test program, both vehicle and systems will be tested as a whole as part of the system wide testing. These activities are described below.

a. Vehicle testing

The testing for the Stadler vehicles includes commissioning and testing activities in Switzerland prior to the vehicles being delivered to Ottawa. These activities include most static type tests with some dynamic tests.

Each vehicle went through commissioning tests upon arrival in Ottawa ensuring basic functionality. Alongside these tests were a concert of type tests to ensure performance requirements were met: Automatic Passenger Counting Static Accuracy; Wheel Load Equalization; Lean Test; Windshield Wiper; Interior Lighting; Battery Capacity; Dim and Back Lighting into Cab; Interior Doors; Exterior Lighting; Event Recorder; Traction Performance; Integration of; Fire Protection; Door Safety; Safety Functions; Deflection Test; Fuel Savings Options; Ventilation, Heating and Cooling; Friction Brake; Braking Performance; Wheel Slide; Protection; Levelling; Radiated Emissions (EMC/EMI); Coupling; and the Smoke Test.

There are outstanding performance tests for Stadler vehicles, however these tests will be performed once the entire system is available. The tests include: Vehicle Data Radio System Train Corridor Coverage Assessment; Automatic Passenger Counting at Stations; Vehicle Dynamic Clearance Tests; Automatic Train Protection (signal system) Integration; Parking Brake Tests; Exterior and Interior Noise Tests; Internal Communications Test; Remote Passenger Information Timetable Update; Wayside Live-View Test; and Wayside Video Upload Test.

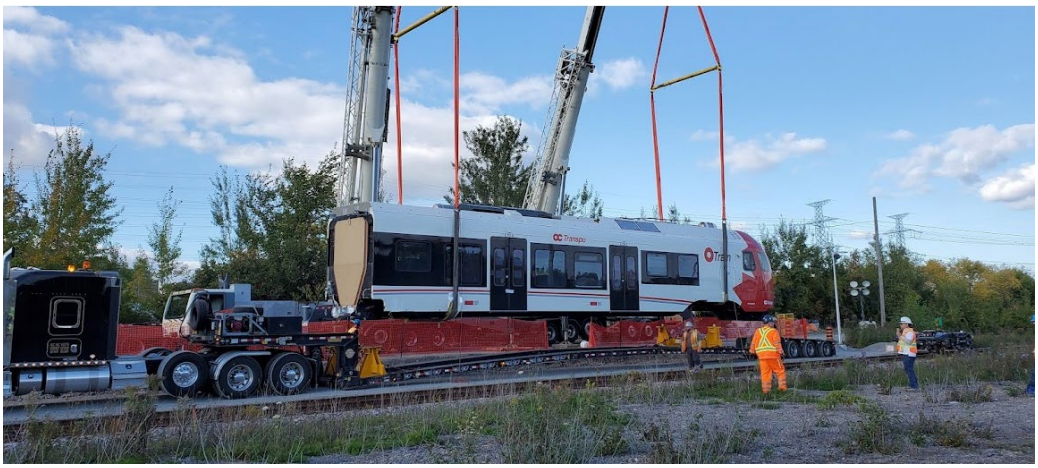

Figure 11

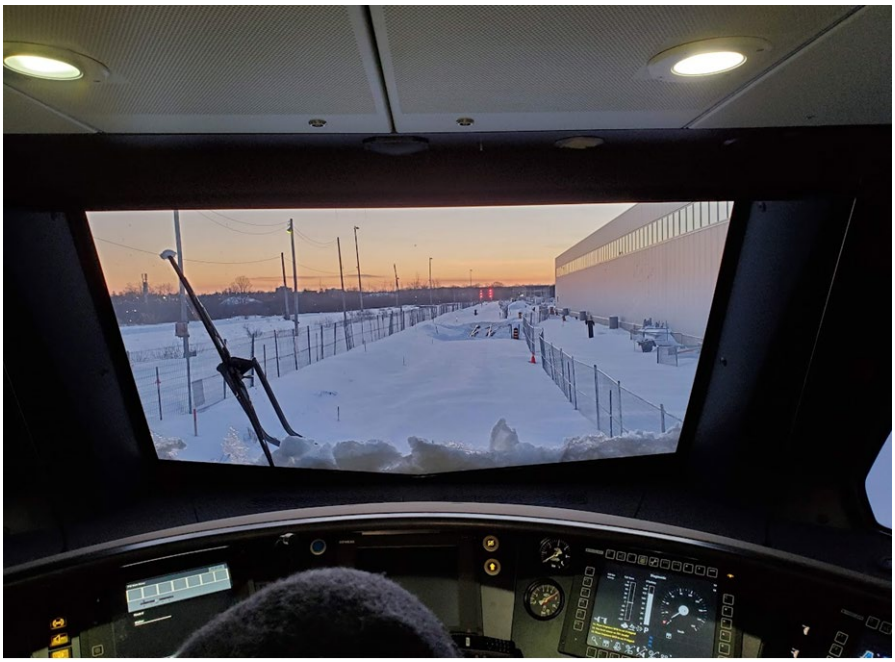

Figure 12

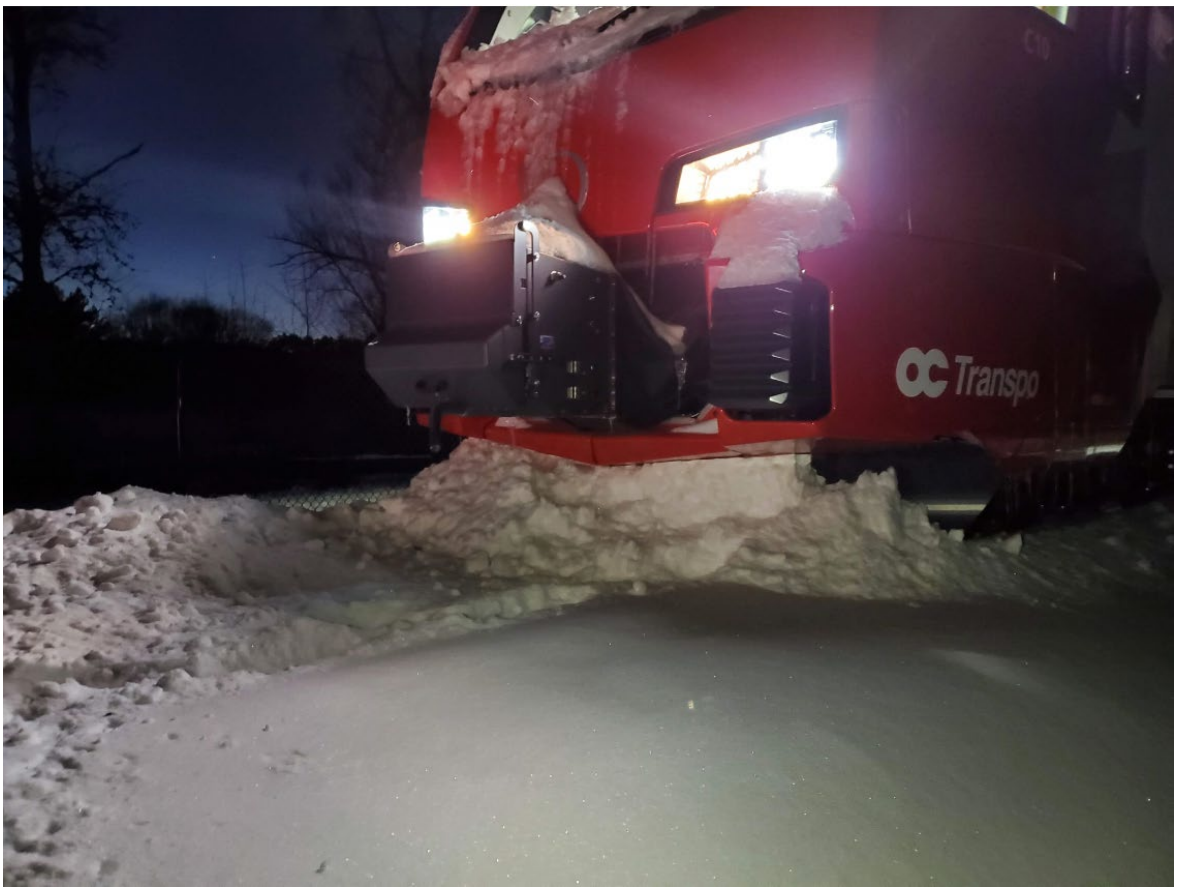

Figure 13

b. Systems Testing

The TransitNEXT Testing and Commissioning (T&C) Plan for the Trillium Line Extension Project is designed to support the systems integration activities and processes necessary to achieve the requirements of the Project Agreement (PA). The approach taken by TransitNEXT is typical of the industry and can be broken out into stages. The sequence of verification, inspection and testing is as follows:

- Pre-Delivery Testing
- Pre-Installation Inspection
- Post-Installation Check-out (PICO)
- System Acceptance tests (SAT)
- System Integration tests (SIT)

Upon delivery and installation of equipment, a PICO test will be completed that includes verification of installation according to design, verification of cabling, and verification of installation. Following the PICO, the equipment is typically energized, and a SAT test is completed. This test is carried out to verify that a system or subsystem installed at a

specific site performs in accordance with the project requirements. SIT tests are then conducted to ensure that the different subsystems and components are integrated as per the design specifications and that they function together seamlessly. Once SIT tests are completed systemwide, commissioning is considered complete and the project can advance to Trial Running.

Some of the major milestones being tracked include the list below. It is important to note that training for both operators and controllers will occur in parallel to these activities:

- Vehicle dynamic testing
- Vehicle Final Acceptance
- Signaling And Train Control System Overall
- Communications Systems SIT
- Systemwide SITS
- OJT Training
- Trial Running (21 days)

The Trillium Line Project T&C program is currently underway. There are 467 SATs anticipated for the project, with a total of 44 of those tests completed, including the submission of the Test Reports. However, as stations, track, and equipment rooms become available, testing is quickly ramping up.

A forecast of key activities and their durations is as follows.

ACTIVITY	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER
FIBER CONNECTION							
SYSTEMS (COMMS)							
S&TCS							
VEHICLES							
VEHICLE BURN-IN							
TRIAL RUNNING							

Figure 14

While the table in Figure 14 indicates that the vehicle commences testing in June, it is important to note that the vehicle testing has been conducted in two waves. Shortly after the initial delivery of the new vehicles (October 2021) testing began in parallel to the delivery of the remaining vehicles (concluded August 2022). This allowed the vehicle test program to complete any testing that did not require the full track alignment.

c. Head-End

The City is responsible for a number of systems in the Transit Operations Control Centre or “Head-End”. The City has specified, procured, and installed the systems and equipment required at Belfast Maintenance and Storage Facility (MSF), as well as at the Transit Operations Control Centre (TOCC) to allow for operation of the line. The City is responsible for all communication systems required for the Line 2 and 4 in the TOCC while TransitNEXT is responsible for the signaling, high speed data radio, and tunnel ventilation interfaces in the TOCC.

In order to advance testing of the TOCC and field equipment, the City has built a temporary test lab that is equipped with all the servers and consoles for Lines 2 and 4. This test lab allowed local setup of equipment and configuration well in advance of when it is required for formal integration with TransitNEXT. Further, TransitNEXT created an equivalent field test lab with all the various communication systems field devices. A remote cellular connection between these labs has allowed early integration testing of various systems. This process has enabled both teams to configure, test, and troubleshoot their various services and end devices before the equipment is installed in the field. This early testing activity has been a key initiative to help reduce the risk for the integration of these components.

4. Transit Services Readiness Programs

Transit Services has implemented a project management strategy to capture all of the various preparatory works from bus route planning to staffing and recruitment that are outside of the contract with TransitNEXT. The Rail Operational Readiness (ROR) and Rail Activation Management Program (RAMP) are two internal programs in the Transit Services Department that are designed to manage the delivery of expanded multimodal transit services as part of the Stage 2 program.

a. Rail Operational Readiness (ROR) Program

The goal of the ROR program is to facilitate the management and scheduling of all activities and projects required to ensure the department is prepared to operate a fully integrated multimodal transit system on opening day of O-Train Line 2 and 4 operations. There are 17 projects that fall within the scope of the ROR mandate and each of these projects includes an assigned City lead, program charter, and project plan.

i. Contract Management

The Contract Management project involves service delivery management and contract administration of Project Agreements (PAs) during the maintenance term. Service delivery management will ensure that service and maintenance are delivered in accordance with the performance and quality measures as specified in the PAs, and associated internal plans, standard operating procedures (SOPs), and Work Instructions (WIs). Contract administration deals with daily management of contracts and processing of monthly service and lifecycle payments.

ii. Transit Operations Control Centre (TOCC)

Introduction of an expanded Trillium Line and Confederation Line into the Transit Operations Control Centre (TOCC) with further integration of systems and processes supporting the O-Train Line 1 and Line 2.

iii. Systems

Transit Engineering Services will provide documentation review, input and witness testing of systems, as well as the control and communication systems required for the project.

iv. Prelaunch Coordination & Live Testing Project

The Pre-launch launch Coordination and Live Testing project ensures that important and necessary steps in preparing and training staff and stakeholders for revenue service and emergency events are being planned and practiced prior to opening for revenue service. Technical drills and integrated exercises, dress rehearsals activities, bus loop operational tests, and tabletop exercises will allow internal and external stakeholders, to plan, review and develop standard operating procedures and work instructions, prior to the revenue service of each of the Stage 2 light rail transit (LRT) extensions. This project is divided into four (4) primary deliverables of prelaunch and live testing activities which will be coordinated by deliverable leads: (1) Tabletop Exercises; (2) Technical Drills and Integrated Exercises; (3) Bus Loop Operational Tests; and (4) Dress Rehearsals Activities.

v. Fare Control

The fare control strategy ensures that all new O-Train stations are ready and equipped to operate the fare management system for day-one operations.

vi. Stage 2 Station Design, Construction & Fit-out Project

The City’s design review process provides input at each design submission stage to ensure the design of the stations are clearly identifiable and meet the needs of OC Transpo’s customers. This project includes reviewing the functional requirements and

design of all spaces, including those used by the customer and by OCT employees that support the active delivery of service.

vii. Operational Planning Project

As part of opening extensions with a live rail system, there is a requirement for coordinated tie-ins between the existing and newly built systems and infrastructure. During this time, there will be shut-down periods of existing service to allow for this work. As well, the testing and commissioning phase may also require temporary train service adjustments to accommodate this work. This project will focus on train timetabling for ultimate completion, rail replacement plans for ultimate completion, and rail replacement service and short turn train provisions during infrastructure tie-ins.

viii. 2025 Bus Network

This project will oversee the development of the revised bus networks that will support the expanded rail network. Through intensive network design, modelling, and scheduling, the project will determine future service hours, bus and operator requirements for each major milestone.

ix. Traffic & Transit Connectivity Project

This project ensures efficient bus operations within new bus loops. Bus movements will be modelled and reviewed to ensure that they are optimized. As well, modifications to roadways and signals, outside of station areas, may be required to ensure effective flows in and out of the stations. The live operational review portion of this project will be coordinated through the "Pre-Launch Coordination and Live Testing" ROR projects.

x. IT Operational Readiness Project

This project will consult, identify, develop and implement IT requirements to support the operational readiness of Stage 2 rail stations and systems.

xi. System Wayfinding Project

Network configuration, stations and vehicles that emerge from Stage 2 will require the development of new or expanded design elements, and new or expanded standards for applications that have not been defined. The project will ensure a consistent application of visual identity and wayfinding across the O-Train system and vehicles.

xii. Training Strategy

This project provides the framework to ensure all activities related to training are captured, defined, and planned in a sustainable rail training program. The structure, tools and

instructors will be in place to ensure OC Transpo (OCT) continues to deliver relevant and effective training into the future.

xiii. Simulator Project

The Simulator project will oversee upgrades to simulators to support operational stakeholders and emergency response training in preparation for the Stage 2 expansions.

xiv. Staffing Project

The Staffing and Recruitment Project will produce and implement strategies that will ensure that the right people are in the right positions at the optimal time. This will ensure objectives are met for Stage 2 testing and commissioning, and for day-one revenue service for the Confederation Line extensions and the Trillium Line extension. These strategies will incorporate tactics from the City of Ottawa Diversity and Inclusion Plan and will meet departmental obligations under the *Employment Equity Act*. This project will also recommend strategies ensuring Transportation Services employees are aware of the new career opportunities that will be produced to deliver on Stage 2. Employees will be informed and prepared to apply for those career opportunities of interest.

xv. Document Support Project

This project will provide oversight for the development or revision of Rail Operational documentation, consistent industry best practices and where applicable consistent with relevant legislation, regulations and rules. The project will also provide oversight for the development or revision of appropriate multimodal documents and business procedures.

xvi. Regulatory Compliance Project

This project ensures regulatory requirements are identified, documented and reported on for Stage 2. This project is managed the Regulatory Compliance, Quality Control & Assurance branch as part of the Safety, Regulatory, Training and Development (SRTD) the service area, which is responsible for ensuring OC Transpo's safety, security and regulatory compliance.

xvii. Communications Project

The communications project will develop the customer readiness, customer info and content, customer journey and the internal communications required in advance of the Stage 2 expansion of the light rail system.

b. Rail Activation Management Program (RAMP)

Ahead of the incorporation and launch of the Stage 2 expansion of Lines 2 and 4, there is a need for enhanced tracking, reporting, discussion, and decision making for all critical activities and milestones. The Rail Activation Management Program (RAMP) structure and reporting mechanisms were developed in Stage 1 and are being used again on Stage 2. RAMP will establish and manage the meeting structure and reporting which will track and support all activities and milestones required for each stage up to the public launch of Lines 2 and 4.

The RAMP Project has produced a list of critical activities for a successful public launch. A “critical activity” is an activity relating to providing services in which disruption may have a significant impact or influence on schedule, cost, safety, quality, environment, and/or operating performance. The list of critical activities will be the basis for the RAMP reporting which will take the form of a Scorecard.

Regularly scheduled RAMP meetings will bring together RAMP leads, consultants, Stage 2 contractors, subject-matter experts (SMEs) (as required), and support staff to discuss updates, coordinate upcoming activities, identify emerging issues, and identify action items and responsibility for resolving issues and action items.

Below are the critical activities included in the Stage 2 RAMP reporting:

- Vehicles and Fixed Components
- Systems, Testing & Communication Systems
- Operations & Maintenance Readiness
- Customer-Facing Projects
- External Communications and Events

For Trillium Line, the construction term ends with a 21-day Trial Running period to achieve Substantial Completion. The system then enters the Operations and Maintenance period, wherein the Transit Services Department can undertake final operational preparations. The RAMP project will support the transition from construction to when the system is handed over to the City and ready for public launch.

The period between Substantial Completion and public launch will focus on the final operational preparedness of all staff and stakeholders. This includes monitoring the progress of drills and exercises, and the rollout of service changes, as well as communication to customers and the public.

5. Trial Running

The last project step after the completion of systemwide commissioning is Trial Running. The main objective of Trial Running is to validate readiness for passenger service and to confirm that the complete integrated system, including all subsystems, operating personnel, and operating procedures are operational and reliable. The specific objectives are as follows:

(i) to validate the performance of the system infrastructure with operating and maintenance staff trained on the operation of the System Infrastructure and Standard Operating Procedures (SOPs);

(ii) to exercise and validate the operating schedules and operational performance requirements; and

(iii) to exercise and confirm the operating reliability of the subsystems simulated under various operating conditions (regular and emergency).

Trial Running is a 21-consecutive-day period that commences upon the successful completion of testing and commissioning. TransitNEXT is required to demonstrate there are no deficiencies to prevent safe running of the system infrastructure, that there is an adequate number of trained staff and resources to maintain the system infrastructure, and that there are an adequate number of trained staff available to support Trial Running operating requirements.

Trial Running is one of the final contractual steps in confirming readiness for passenger service and includes demonstrating compliance with the overall reliability requirements for the comprehensive system. TransitNEXT uses the Trial Running period to collect operating data and evaluate system reliability, availability, and maintainability performance.

Data on service deviations is collected and assigned against the vehicles and specific subsystems down to the Line Replaceable Unit (LRU) level. The database verifies system reliability to the LRU level. If the cumulative failure of any LRU exceeds 10 per cent of the total LRU population, up to and including the completion of Trial Running, TransitNEXT will redesign and replace the defective LRUs.

Trial Running is performed when:

(i) Integrated System Infrastructure has been tested.

(ii) Complete fleet is fully tested and ready for passenger service.

(iii) Complete signalling and train control system and associated TOCC equipment is fully tested, ready for passenger service.
(iv) No outstanding defects (major or minor) affecting rail systems functionality, including track, signals, and communications.
(v) No major defects, safety defects, or incomplete vehicle modification programs.
(vi) All stations substantially complete with only Minor Deficiencies remaining.
(vii) TransitNEXT is fully mobilized and ready to commence maintenance services including availability of required maintenance staff, parts, maintenance equipment, CMMS, and completion of training.
(viii) TransitNEXT has submitted the Maintenance & Rehabilitation Compliance Verification & Validation Matrix.
(ix) City is fully mobilized, trained and ready to operate the system.

TransitNEXT shall achieve the Service Reliability Standard outlined in Schedule 15-2, Part 1, Article 3.5 wherein the 98.5 per cent on-time performance must be achieved over a 14-day period within the 21-day Trial Running period. Trial Running shall operate a full regular scheduled service on the full line for a 14-day period. Failure to achieve 98.5 per cent on-time performance on any single day within the 21 consecutive days shall not instigate a restart of Trial Running if the service reliability standards can be achieved within an averaged 14 day rolling period.

The City has established a Service Reliability Standard of 98.5 per cent on-time performance, where a trip is considered on time if it is available to depart the following Terminal Stations within 30 seconds of scheduled departure time, respecting a minimum terminal time of three minutes for:

A. Line 2 Mainline – Bayview and Limebank
B. Line 4 Airport link – Airport and South Keys

The City may choose, but shall not be obligated, to reduce terminal time for the purposes of achieving an on-time departure.

Passengers will not be carried during Trial Running, therefore the simulation of passenger interaction with system infrastructure including but not limited to station facilities and vehicles will not be a criterion for Trial Run performance over the 14-day performance period. The remaining 7-day period in Trial Running shall include a variety of failure management scenarios that could reasonably be expected to occur in regular Revenue Service. The City shall have the opportunity to review and approve the failure management scenarios that will be tested during Trial Running.

The Trial Running of the system infrastructure will demonstrate to the satisfaction of the Independent Certifier that the specified travel times, headways and operational performance requirements can be achieved.

During the Trial Running Period, the Rail Construction Office will submit a daily report to Council advising of the outcome for the previous day's Trial Running, including the on-time performance. At the completion of Trial Running, a full technical briefing will be provided to council.

This technical briefing will outline:

1. The progression of the running average achieved in terms of on-time performance.
2. The results achieved for the integrated system based on the maintenance period performance criteria.
3. Results achieved for the failure management scenarios executed.
4. A summary of issues encountered.

6. Substantial Completion

Substantial Completion is the final contractual step that is achieved when the various infrastructure elements have been completed in accordance with the Project Agreement. The Independent Certifier will certify the substantial performance of the Construction Contract and the related certificate of substantial performance of the Works will be published according to the *Construction Lien Act*. This step will confirm that all contractual requirements for Readiness for Revenue Service have been satisfied in respect of the infrastructure as a whole.

Leading up to Substantial Completion, the City, TransitNEXT and the Independent Certifier work together to ensure all requirements and any deficiencies are captured on a deficiencies list. All documentation is required to demonstrate the fulfillment of requirements have been captured.

Prior to delivering their Substantial Completion certificate, TransitNEXT must provide a notice 10 business days in advance. Once TransitNEXT submits the Substantial Completion Notice and supporting details and documentation, the City has five business days to provide the Independent Certifier with its opinion on whether it feels that all conditions and requirements for Substantial Completion have been satisfied by TransitNEXT. The Independent Certifier then has a further five business days to issue its opinion on whether the conditions to issue a Substantial Completion certificate have been satisfied.

Substantial Completion will be demonstrated by the issuance of a certificate acknowledging substantial completion availability by the Independent Certifier, along with a Minor Deficiency List. Minor deficiencies refer to defects, deficiencies, and items of outstanding work, including in relation to seasonal work, arising from or related to the work required to achieve substantial completion and that would not materially impact:

- The public's, system users', third parties and City's use and enjoyment of the system infrastructure.
- The performance of the governmental activities.
- The performance of the maintenance and rehabilitation services by Project Co.
- Safety, security, or traffic flow on the system infrastructure in any relevant respect.

If the Independent Certifier does not feel that the conditions have been met, a report will be issued outlining what is yet to be completed/performed by TransitNEXT to satisfy the Substantial Completion certification conditions. If either Party (TransitNEXT or the City) disagrees with the Independent Certifiers decision, the matter may be referred to the Dispute Resolution Procedure.

Following certification of Substantial Completion, the maintenance term will begin and TransitNEXT's maintenance obligations will come into effect. The City will continue to operate the system according to the daily schedule and will make a subsequent determination on a public launch date.

7. TransitNEXT Maintenance

As part of the Trillium Line Project Agreement, TransitNEXT is responsible for the maintenance and rehabilitation of the Lines 2 and 4 system infrastructure and the new and existing vehicle fleet. These maintenance and rehabilitation services commence on the day immediately following the Substantial Completion date and continue until the completion of the 27-year maintenance period.

TransitNEXT's responsibilities during this period include the requirements to procure, deliver, install, commission, maintain, repair, decommission, upgrade and replace any equipment required by TransitNEXT to perform the maintenance and rehabilitation services. In doing so, TransitNEXT shall not close all or any portion of the system infrastructure in any circumstances other than as directed or approved by the City, acting reasonably.

During the maintenance period, TransitNEXT must monitor the performance of the maintenance and rehabilitation services in the manner and at the frequencies set out in the Project Agreement and shall compile and maintain records which are accurate and complete of such monitoring and performance. This performance information will then inform the City in their application of the prescribed payment mechanism calibration exercises and failure point thresholds to allow the City to impose its performance management rights under the Project Agreement. The Project Agreement schedule has been published on the City's Routine Disclosure page.

TransitNEXT is responsible to establish and maintain a Maintenance Committee (comprised of representatives from TransitNEXT and the City) to assist with the promotion of cooperative and effective communications related to matters of scope of the project, both prior to and during the maintenance period.

a. Line 2 Vehicle Warranty

Warranties required for the O-Train Line 2 light rail vehicles between Stadler Bussnag AG (the "Vehicle Supplier") and SNC-Lavalin Constructors (Pacific) Inc (the "Construction Contractor"), are described in the Project Agreement as "Revenue Vehicle Supply Contract". These warranties provide for:

1) a General Warranty Period which commences on the final acceptance of each vehicle and continues for two years. Final acceptance of all Vehicles is currently anticipated by the end of June 2023;

2) an Endemic/Epidemic Protection Period which commences on the final acceptance of the first Vehicle and ends on the 5th anniversary of the final acceptance of the last Vehicle; and

3) a Latent Defects warranty for defects in existence at the final acceptance of each vehicle, but which was not discoverable during the General Warranty Period noted in item 1) and continues for 15 years.

These warranties exist between the Vehicle Supplier and the Construction Contractor, and for the benefit of the Construction Contractor. The City is not the beneficiary.

Regardless of warranties, the City's performance-based contract requires that TransitNEXT upholds its obligations under the PA to perform, maintain and ensure the availability of the Line 2 and 4 system throughout and up to the end of the Project Term. Section 20.1(b) of the PA, notes that at any time during the Project Term, if the System

Infrastructure or any parts thereof, does not fully satisfy the Output Specifications and/or any other term or condition of the PA, TransitNEXT shall, at its own cost and expense, rectify the System Infrastructure and any part thereof so that it does. As a result, the City has a guarantee of performance, maintenance, and system availability from TransitNEXT for the entire duration of the Project Term.

Furthermore, PA Schedule 15-3, Appendix C sets out the requirements for the Line 2 and 4 system upon hand back to the City at the end of the Project Term. The Line 2 and 4 system assets, including the Vehicles, must be “fully operational and functional”. The purpose of this section is to protect the City from excessive wear on the system during the maintenance term and facilitate handover of the system to the City in a condition that reflects proactive maintenance and rehabilitation throughout the maintenance term. Additionally, at the time of handover, the Line 2 and 4 system is required to have no material deficiencies and require no urgent maintenance.

These PA provisions are intended to protect the City’s long-term interests in the system and its assets, including the vehicles.

8. Operations

The City of Ottawa will operate the expanded system of O-Train Lines 2 and 4. A safety management system will be applied as part the operation of the system, as per the Railway Safety Management System Regulations (SOR/2015-26) and the City’s Safety Management System.

The operating organization for Lines 2 and 4 will include staff at the TOCC, and Backup Control Centre (as required); field staff which includes Rail Supervisors, transit Supervisor and Special Constables; Diesel Rail Operators and Controllers (DROs and DRCs); and other staff, as appropriate (including training and safety staff).

The City is responsible for ensuring that the necessary training and certification has been conducted for Diesel Rail Operators (DROs), the TOCC and other staff required to operate Lines 2 and 4. Staff competence will be assured through the appropriate recruitment, selection, and training of staff. Training will use simulations of train operations, train control, failure detection and annunciation. Additionally, the City will revise and create new standard operating procedures and other directives and bulletins to formalize the changes, which will be integrated into the established training curriculum ahead of the start of operations.

b. Transit Control Centre Operations

Transit Control Centre rail operations will be managed by TOCC Rail Control staff and Communication Officers, under the supervision and management of the existing Superintendents and TOCC Manager. During revenue service, Rail Control will be responsible for:

- Issuing all required track authorities;
- Monitoring and controlling all revenue vehicle movements on mainline track in accordance with the service schedule; and adjusting where necessary;
- Accepting revenue vehicle movements from Albion Yard onto the mainline, and initiating vehicle movements from the mainline into Albion Yard;
- Monitoring and controlling all non-revenue vehicle movements on mainline track in accordance with the rules and procedures;
- Monitoring of SCADA, tunnel ventilation systems and other equipment;
- Coordinating all incidents/emergency responses;
- Liaising with the maintenance organization as necessary;
- Supporting DROs and field staff delivering incident/emergency management response, customer assistance, fare enforcement and security functions;
- Liaising with Special Constable Unit (SCU) Communication Officers;
- Liaising with Bus operations to handle any operational issues of joint concern; and
- Liaising with field staff at Transfer stations to handle operating emergencies or service/customer issues at those Transfer stations.

c. Field Operations

Field staff supporting rail operations include Supervisors and Special Constables. Support for operations by these groups will be an extension of support currently provided for existing transit modes, with staff sign-on from current facilities. Supervisors and Special Constables operate throughout the complete OC Transpo network.

d. Train Operations

Diesel Rail Operators (DRO) will operate trains during revenue service and will perform “sweep” functions at the start of service on the first train through each section of line to ensure the line is clear of vehicles / obstructions and safe in preparation for service. DROs will be required to follow service plans and operating rules and procedures. Revenue service vehicles will normally be operated by one DRO, using manual driving with speeds enforced by the signal system on all sections of the line.

e. Bus Operations

Current bus routes will be adjusted to connect with the new O-Train service when it opens. Routes 74, 99, 198, 278, and 299 will connect with Line 2 at Limebank Station. Routes 93, 99, and 299 will connect at Leitrim Station. Route 197 will connect with Line 4 at Uplands Station. Existing routes will connect with trains at South Keys, Greenboro, Walkley, Mooney's Bay, Carleton, Dow's Lake, and Corso Italia stations. O-Train Line 1 and existing bus routes will connect with Line 2 at Bayview Station.

Staff are examining possible further improvements to bus routes in areas along O-Train Lines 2 and 4 as part of the bus route review. This review is currently underway, and includes consultation with customers, Councillors, and other stakeholders.

9. Project Schedule & Delivery Risks

The current project schedule points to start of systemwide testing (Bayview Station through to Limebank Station and South Keys Station through to Airport Station) this summer. Assuming timely completion of the works, the start of Trial Running is tentatively planned for late September with handover of the system to the City in October. Following successful completion of Trial Running and the various associated regulatory approvals, the City would be in position to review and assess an opening date. The final date selected will be heavily influenced by the safety, reliability, and general performance of the system through the beginning of October. Further information on this specific item will be provided as part of the Technical Briefing on Trial Running.

The City continues to monitor progress of the works for an early October handover; however, a number of risks exist that may have an impact on the final schedule. These risks are noted below.

a. Safety & Security Management

A significant safety incident during the remaining construction period, due to the complexity of the operation increasing during testing and commissioning of trains, would result in a project delay. The rollout of TransitNEXT's Construction Safety Management Plan (CSMP) accompanied with City presence on-site will be used to help prevent the occurrence of a major safety incident during the final stages of project completion.

Furthermore, systemwide testing is used as a final demonstration that the design, construction, and commissioning have been successful; however, this process has the potential to surface a critical safety issue in which case, additional project time would be required to resolve the issue. In order to help mitigate this risk and assess the possibility

as early as possible in the project, there has been a progressive ramp-up of testing activities from an individual component level to system integration testing level along with interface control documents to identify and manage the system interfaces.

b. Systemwide Testing / Performance

As a follow on from the potential for safety incidents, systemwide testing may surface a technical, reliability, and/or performance issues that requires additional time to resolve. Specifically, the process could identify issues with reliability of a specific vehicle system or infrastructure element. Similarly, challenges could be encountered with delivery of operations or maintenance which would require additional project time to resolve. At present, the critical system that has the potential to create delays as a result of issues arising out of the testing program is the signal system.

c. Training Completion

Training of Diesel Rail Operators and Diesel Rail Controllers is a critical final step in bringing the system into service. The screening, recruitment, and training process for these positions is extensive and requires access to the complete infrastructure in order to fulfill all of the training hours and competency tests. Delays to infrastructure readiness will delay training and would require additional time to prepare for launch. Equally, challenges and/or attrition during training would create a requirement for additional time. Transit Services has been working diligently on this matter and has been leveraging tools to mitigate this risk including with the use of simulators and participation by staff in the testing process. Timely completion of infrastructure and testing will be the primary driver for mitigation delays to training activities.

d. Regulatory Requirements

Critical to the opening of Line 2 and 4 are the rail regulatory approvals from Transport Canada. There are key risks emerging related to the compliance with new regulations and some new requirements which are being triggered by issues on Stage 1.

- Updated regulations require the installation of Locomotive Voice and Video Recorders (LVVR) on the new and existing vehicles. These units are black boxes which record operator activity in the cab. Due to manufacturing delays related to these units, they are not scheduled for delivery until September 2023 which poses a risk to the start of service.
- A new requirement for wayside bearing detection emerged for the project. The original Trillium Line was never equipped with this technology and there is currently

significant market pressure for these units given recent freight incidents. An implementation plan and interim agreement on mitigations will be required to satisfy new regulatory expectations.

- An updated interpretation of operating rules for operators requires more extensive and active monitoring of vehicles in service. The City is still assessing this requirement and the potential implications of this change as it was not required during the original Trillium Line service.

The City is working closely with Transport Canada and various equipment manufacturers to assess timelines for implementation of these solutions and to assess alternative solutions/mitigations.

e. Construction Completion

Importantly, the City continues to track progress of the works against the overall project schedule. Notwithstanding completion of final commissioning, training, and achievement of regulatory approvals, final completion of construction is required to enable these follow-on activities. Key remaining works include the following:

- Station completions including commissioning of electrical, mechanical, and communication systems in order to achieve occupancy.
- Major civil works including Bowesville park & ride, Leitrim park & ride, Limebank bus platforms and road network, Hunt Club Bridge including a short section of trackwork, and Rideau River Pedestrian Bridge.
- Signal system testing and commissioning.

As part of building on the collaborative and consensus-based approach to project delivery, the City is working with TransitNEXT to identify potential items that are not required for Substantial Completion. Items such as final landscaping, final electrical and mechanical works for the pedestrian bridge linked to future 900 Albert Street, and some roadway works could potentially be deferred while still allowing Lines 2 and 4 to open. This approach will allow additional level loading of construction resources while not affecting the delivery of Line 2 and 4 operations.

f. The Ottawa Hospital

The proposed New Campus Development (NCD) sites for The Ottawa Hospital are separated by City-owned railway property. The hospital parking garage is proposed to be constructed over part of O-Train Line 2.

The project and timing have added pressure to the City's Trillium Line Project and O-Train Line 2 operations. The City and TransitNEXT are coordinating with the Ottawa Hospital design and construction team to ensure any risks the hospital works have induced are appropriately mitigated, avoided or transferred. More specifically, coordination to prevent any impacts to the construction or operations of Line 2 are underway. We expect there to be construction activities in the future that may conflict with the operation of train service in this segment of the line and the City may negotiate short service interruptions to enable The Ottawa Hospital to build certain elements of the garage structure.

10. Final Steps to Opening

Subsequent to Trial Running and certification of Substantial Completion, the City will be undertaking an additional dress rehearsal as part of the ROR program, with staff and other volunteers presenting as customers, to further exercise the system and provide operations and maintenance staff with a further opportunity to build their proficiency with the system. At that time, the City will be well positioned to make a decision regarding selection of an opening date and/or to determine an additional period of train running time to provide additional assurances regarding system performance.

Based on a potential fall opening, the City plans to keep the current Line 2 replacement bus service, operating between Bayview and South Keys stations, as well as the current service on Route 97 to the airport and Route 99 through Riverside South, in place through April 2024 at a minimum. A final decision regarding the end date for the service will be contingent on demonstration of reliability of the system during initial operations.

FINANCIAL IMPLICATIONS

There are no financial implications associated with the recommendations of the report.

LEGAL IMPLICATIONS

There are no legal impediments to implementing the recommendations as outlined in this report.

COMMENTS BY THE WARD COUNCILLOR(S)

This is a city-wide report.

CONSULTATION

Stakeholder and public consultations are outlined in the report.

ACCESSIBILITY IMPACTS

All components of the Stage 2 O-Train project adhered to the *Accessibility for Ontarians with Disabilities Act* (AODA).

Any policy or procedural development, as well as customer communications and public engagement identified in the report's recommendations will include the application of the City's Equity and Inclusion Lens. Staff will continue to engage persons with disabilities and accessibility stakeholders to ensure that their perspectives are considered and incorporated, and to promote inclusion.

Staff will also ensure that any applicable accessibility legislation, standards and guidelines are adhered to during the execution of the projects and initiatives identified in this report.

ASSET MANAGEMENT IMPLICATIONS

New rail system infrastructure being built for Line 2 and 4 will be maintained by TransitNEXT as per the maintenance and lifecycle requirements of the contract. The contract details to the standard for asset condition and remaining life expectancy for the vehicles and infrastructure at the end of the 27-year contract. The Project Agreement also details a specific third-party inspection program and assessment process leading up to the end of the contract.

For assets that are not directly part of the rail system infrastructure, these assets will be handed over to the City and they will be incorporated into the City's asset management programs for City infrastructure. Example of assets that will maintained by the City include park and ride facilities and bus operator buildings. Additionally, new system equipment that has been being procured and installed by the City at the TOCC, is planned to be maintained by Transit Services.

CLIMATE IMPLICATIONS

Ottawa's Climate Change Master Plan established greenhouse gas (GHG) reduction targets of 100 per cent by 2050 for the city as a whole and 100 per cent by 2040 for the municipal corporation. The transportation sector contributes 44 per cent of Ottawa's overall GHG emissions, so achieving these targets will require significant shifts in vehicle technology and travel behaviour, as outlined in the City's Energy Evolution Strategy. The O-Train Line 2 and Line 4 extensions expand on the Stage 1 Confederation Line system to provide sustainable transit and a transition to cleaner vehicle technologies.

As outlined in the recent Transportation Master Plan Update (ACS2023-PRE-TP-0001),

The shift to walking, cycling and transit use is critical to reducing GHG emissions and is already at the heart of the City's transportation planning.

The technology incorporated as part of this project will reduce GHG emissions by providing high-efficiency vehicles, which will also reduce fuel consumption, and reduce the number of vehicles on roads by.

ECONOMIC IMPLICATIONS

The Trillium Line extension project, including the Airport Link (O-Train Line 2 and 4), will provide a significant benefit to Ottawa's economy and support economic diversification, economic growth, business attraction and talent attraction. The project has delivered a number of construction jobs and provides opportunity for new business investment. The project will create a new transit option for residents, students and tourists.

RISK MANAGEMENT IMPLICATIONS

Risks directly associated with the testing and commissioning of the Stage 2 O-Train extensions to the south are outlined in this report. In addition, TSD staff have reviewed and responded to the November 2022 Ottawa Light Rail Transit Public Inquiry Report. Some of the recommendations from the Public Inquiry do relate to the Trillium Line Project, as noted throughout the report.

Based on previous lessons learned reviews, third-party reviews, external oversight and consultation with international light rail professionals, improvements have been made to the Stage 2 LRT model – from design to procurement to construction to contract management.

The risks associated with the OLRT Public Inquiry Report are being tracked and mitigated through the City's Action Plan.

RURAL IMPLICATIONS

The City's transportation network, including light rail transit, is designed to provide options for all residents. Once completed with the Stage 2 extensions, the City's O-Train network will span from Trim Road to Moodie Drive and south all the way to Riverside South. Rural residents will have access to Park and Ride lots at various stations which will allow them to easily use public transit.

For Line 2 specifically, there will be Park and Ride lots at Bowesville Station, Leitrim Station, and Greenboro Station.

TERM OF COUNCIL PRIORITIES

The 2019-2022 Term of Council Priorities include:

- This report supports the City's on-going commitment to financial sustainability and transparency.
- Integrated Transportation: Enable effective mobility through a sustainable, accessible, and connected city transportation system.
- Service Excellence Through Innovation: Deliver quality services that are innovative and continuously improve to meet the needs of individuals and communities.

SUPPORTING DOCUMENTATION

Document 1: O-Train Light Rail Transit Line 1 and Line 2 Comparison Memo

Document 2: Public Release of the Stage 2 Confederation Line and Trillium Line Project Agreement Schedule 14 – Testing and Commissioning

Document 3: Trillium Oversight Memo

DISPOSITION

As outlined in the Recommendations of this report, the Transit Services Department will provide regular updates to Council during the Trial Running Period of Lines 2 and 4 of the Stage 2 LRT project.